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Model Predictive Control for an Industrial SAG Mill

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Abstract: We discuss Model Predictive Control (MPC) based on ARX models and a simple lower order disturbance model. The advantage of this MPC formulation is that it has few tuning parameters and is based on an ARX prediction model that can readily be identified using standard technologies from system identification. When applied to MIMO systems we call this controller a MIMO-ARX based MPC.
We use an industrial Semi-Autogenous Grinding (SAG) mill to illustrate the performance of this controller. SAG mills are the primary units in a grinding chain and also the most power consuming units. Therefore, improved control of SAG mills has the potential to significantly improve efficiency and reduce the specific energy consumption for mineral processes. Grinding circuits involving SAG mills are multivariate processes. Commissioning of a control system based on a classical single-loop controllers with logic is time consuming, while MPC has the potential to both improve the control performance and the commissioning time and expertise required.
The simulation results demonstrate that the MPC based on a MIMO-ARX model is able to provide nice control performance measured by its ability to track an output reference and reject unknown disturbances. Furthermore, the method used to design the controller represents a systematic method that can be automatized for wide-spread deployment in industrial environments.

Keywords: Model Predictive Control, ARX Model, SAG Mill, Mineral Processes, Industrial Process Control